State Water Resources Control Board

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GRADE I OPERATOR CERTIFICATION EXAMINATION INFORMATION AND SAMPLE QUESTIONS

The Grade I examination contains questions regarding the following subjects: basic safety practices, hazards encountered during wastewater treatment plant operations, sampling and simple analysis of wastewater constituents, operation and maintenance procedures in preliminary and primary treatment unit processes, anaerobic sludge digestion and disinfection. It also includes specific questions on the operation and maintenance of wastewater stabilization ponds and state regulations regarding the classification of wastewater treatment plants and operator certification.

The Grade I examination also contains mathematical questions. Examinees may be asked to calculate a variety of problems including chlorine demand/residual, overflow rates, removal efficiency (% removal), pumping rate, solids concentration, detention time, hydraulic or organic loading rates and volume or surface area. The examinee should be familiar with typical calculations related to the subject matter listed in paragraph 1.

Examinees are given 2 ½ hours to complete the examination. The question format is as follows:

45 True/False Questions	@	1 point each
25 Multiple Choice Questions	@	2 points each
10 Math Problems	@	4 points each
	TOTAL POINTS	135

The following are examples of the types of questions that you would find on the Grade I certification examination (see attached key for answers).

True/False Questions

1. Hydraulic loading to a pond is generally expressed as gal/day/ft².

2. MCRT refers to the average number of days that a "cell" remains in an activated sludge system.

3. The major components of anaerobic digester gas are methane and hydrogen sulfide.

4. Raw influent settleable solids are measured in units of mL/L.

5. A trickling filter allows the flow to slowly trickle through a filtration bed in order to remove large particulates by physically screening them.

6. In the wastewater field mg/L and ppM are considered to be equivalent.

Multiple Choice Questions

7. Which one of the following statements is **TRUE** in regard to the concept of pH?
    a. pH indicates the amount of total alkalinity available.
    b. A raw sludge sample with a pH of 6.5 is slightly basic.
    c. Bacteria in wastewater generally function well at a pH near 7.0.
    d. A pH meter gives the percent hydrogen ion concentration as its direct readout value.
    e. Accurate pH measurements on raw wastewater require that a 24-hours flow-proportioned sample be collected.

8. Which one of the following statements regarding facultative ponds is TRUE?
    a. DO concentrations may often exceed 10 mg/L during the afternoon of a warm and sunny day.
    b. The pH may fall as carbon dioxide is consumed by algae.
    c. Aerobic bacteria produce oxygen that is consumed by algae.
    d. A facultative pond has no anaerobic layer and no aerobic layer.
    e. Facultative ponds are operated only in series, never in parallel.

9. The amount of chlorine used per day from a 1 ton chlorine cylinder is normally determined by:
    a. Pressure gauges.
    b. Rotometers.
    c. Weighings.
    d. Chlorine residuals.
    e. Ammonia equivalents.

10. The total solids in wastewater would be a combination of:
    a. Fixed solids and settleable solids.
    b. Dissolved solids and volatile solids.
    c. Dissolved solids and suspended solids.
    d. Suspended solids and fixed solids.

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e. Fixed solids and dissolved solids.

11. What is the percent of BOD removed in a plant when the influent BOD is 245 mg/L and the effluent BOD is 22 mg/L?
    a. 91%
    b. 86%
    c. 35%
    d. 13%
    e. 9%

12. A plastic float is dropped into a wastewater channel and is found to travel 10 feet in 4.2 seconds. The channel is 2.4 feet wide and is flowing 1.8 feet deep. Calculate the flow rate of this wastewater in cubic feet per second.
    a. 1.0 ft³/sec.
    b. 2.3 ft³/sec.
    c. 4.2 ft³/sec.
    d. 5.7 ft³/sec.
    e. 10.3 ft³/sec.

13. What is the detention time in a stabilization pond if the influent flow rate is 0.785 MGD, the pond depth is 4.5 feet, and the pond covers 17 acres?
    a. 97 days.
    b. 56 days.
    c. 32 days.
    d. 14 days.
    e. 4.2 days.

14. What is the volume of water (in gallons) in an upright 25 foot diameter cylindrical tank with a water depth of 22 feet?
    a. 10,794 gallons
    b. 13,750 gallons
    c. 80,737 gallons
    d. 90,022 gallons
    e. 102,850 gallons

15. Thirty-four hundred and fifty (3450) gallons of primary sludge is pumped to an anaerobic digester. How many pounds of V.S. are pumped to the digester if the sludge contains 4.3% T.S. and 76% V.S.?
    a. 25,806 lbs.
    b. 12,370 lbs.
    c. 1,237 lbs.
    d. 940 lbs.
    e. 715 lbs.

ANSWER KEY

GRADE I

1.	False	6.	True	11.	A
2.	True	7.	C	12.	E
3.	False	8.	A	13.	C
4.	True	9.	C	14.	C
5.	False	10.	C	15.	D

THINGS TO KEEP IN MIND

1. A one-page "Formulas and Equivalents" sheet is included in the front of each examination (see attachment).

2. All multiple choice questions have only one right answer.

3. On the math problems SHOW ALL YOUR WORK. You may receive partial credit.

4. REMEMBER: In order to pass, you must achieve an overall score of at least 70%. Also be aware that you are required, in addition, to score at least 50% on the math section of the examination to pass.

STATE WATER RESOURCES CONTROL BOARD
OPERATOR CERTIFICATION EXAMINATION

EQUIVALENTS

1 acre = 43,560 square feet

1 cubic foot of water = 7.48 gallons

1 gallon = 8.34 pounds

1 day = 1,440 minutes = 86,400 seconds

1 million gallons/day = 694 gallons/minute = 1.547 cubic feet/second = 3.069 acre-feet/day

1% = 10,000 mg/L

π = 3.14

1 in. mercury = 1.133 feet of water

1 psi = 2.31 feet of water

1 HP = 0.746 Kw = 550 ft-lb/sec = 33,000 ft-lb/min

FORMULAS

Area of a rectangle = Length x Width

Area of a circle = $\dfrac{\pi}{4}$ x Diameter² = 0.785 x Diameter²

Volume of rectangular tank or circular tank with uniform depth = Area x Depth

Volume of cone = 1/3 x Base Area x Depth

Circumference = π x Diameter

Velocity = $\dfrac{\text{Flow}}{\text{Area}}$

Deterntion time = $\dfrac{\text{Volume}}{\text{Flow}}$

Pounds/day = 8.34 x Flow, mgd x Concentration, mg/L

F/M = $\dfrac{\text{Pounds of BOD applied per day}}{\text{Pounds of MLVSS under aeration}}$

MCRT = $\dfrac{\text{Pounds of MLSS in secondary system (aeration tank + clarifier)}}{\text{Pounds of MLSS leaving secondary system per day (effluent + WAS)}}$

Water HP = $\dfrac{\text{Flow, gpm x Total Head, ft}}{3960 \ \frac{\text{gpm} \cdot \text{ft}}{\text{HP}}}$

Brake HP = Power to electric motor x Motor efficiency